

NOTE ON THE ORIGIN OF THE YELLOW PIGMENT
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(*Preliminary Communication.*)

IN 1894 I described¹ a process for the extraction from normal urine of the pigment to which the yellow colour of that excretion is almost entirely due. In this process the chief materials employed are ammonium sulphate, alcohol and ether, and the use of acids and of metallic precipitants is wholly dispensed with. It was further shown that the properties of this pigment, both in the solid state and in solution are entirely different from those of urobilin, and that before the spectroscopic solutions of the yellow pigment show no absorption band, but owe their colour to a general absorption of the violet end of the spectrum.

More recently the subject has engaged the attention of Prof. Riva of Parma², and of his pupil Dr Peppino Chiodera³, who confirm the statements made in the paper above referred to, both as to the working of the process and the properties of the product obtained.

Moreover they have obtained, by the action of potassium permanganate upon solutions of urobilin, a substance which has the characteristic properties of the yellow pigment of urine with which they believe it to be identical.

Hence they conclude that the fundamental yellow pigment of urine, although essentially different from urobilin, is related to that substance and has a similar origin.

The object of the present preliminary note is to call attention to the fact that when a neutral alcoholic solution of the natural yellow pigment, prepared with every precaution to ensure the highest degree of

¹ Garrod. *Proc. Roy. Soc.* LV. p. 394. 1894.

² "Sulla genesi dell' urobilina, etc." *Gazzetta Medica di Torino*, XLVII. No. 12. 1896.
"Sull' origine del Pigmento giallo fondamentale delle Urina." *Clinica Medica di Parma*. 1896.

³ "Contributo allo studio della genesi del pigmento giallo fondamentale dell' Urina." *Archivio Italiano di Clinica Medica*, xxxv. p. 505. 1896.

purity attainable (showing no absorption band, and entirely free from the ordinary chromogen of urobilin), is acted upon by pure aldehyde a dark absorption band gradually develops in the position of the urobilin band. Like that of urobilin this band consists of a darker portion towards the red and a deep shading extending towards the violet; and when zinc chloride and ammonia are added to the liquid a brilliant green fluorescence appears and the band of urobilin-zinc is seen. The development of the band takes place even at the ordinary temperature of the room, but is greatly accelerated by warmth.

Riva found that the amount of yellow pigment formed by the action of potassium permanganate upon urobilin is remarkably small, and conversely I find that the amount of urobilin-like substance formed by the action of aldehyde upon the natural yellow pigment is surprisingly large.

I have spoken of the product obtained as an urobilin-like substance because, although it possesses the essential properties of urobilin, it differs from the urobilin isolated from urine in much the same way as do the products artificially prepared from bilirubin and from hæmatin; and I have found that Riva's product, when treated with aldehyde, yields a substance showing similar differences from the original urobilin from which it was prepared by oxidation with potassium permanganate.

I do not propose to enter here into any discussion of the experiments carried out with a view to making sure that it is the yellow pigment itself which undergoes the change above described, but will reserve this for a more detailed communication. It should, however, be mentioned that specimens of the yellow pigment prepared by an entirely different method recently described by Kramm¹ give similar results.

The urobilin-like product is not formed when aldehyde is added to the original urine, nor to an aqueous solution of the yellow pigment, but when the aqueous solution is evaporated to dryness and the residue is dissolved in alcohol the change takes place.

Seeing that substances having the properties of urobilin have hitherto been obtained in the laboratory from hæmatin, hæmatoporphyrin and bilirubin only, the above results, taken in conjunction with those obtained by Riva and Chiodera, render it in the highest degree probable that the essential yellow pigment of urine is derived primarily from the blood pigment, and, less remotely, from the pigment of bile.

¹ "Ueber ein neues Lösungsmittel der Harnfarbstoffe." *Deutsche med. Wochenschr.* xxx. pp. 25 and 42. 1896.